JRC NMEA Packet User Manual

JRC Co.,Ltd.

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1. Input Data Format (Host to GPS Receiver)

Preamble	TalkerID	PktType	DataField	*	CHK1	CHK2	CR	LF

Packet Length:

The maximum length of each packet is restricted to **255** bytes

Packet Contents:

Preamble: One byte character.
'$'

TalkerID: Four bytes character string.
"PJRC"

PktType: Three bytes character string.
From "**000**" to "**999**"
An identifier used to tell the decoder how to decode the packet

DataField: The DataField has variable length depending on the packet type.
A comma symbol '**,**' must be inserted ahead each data filed to help the decoder process the DataField.
*****: 1 byte character.
The star symbol is used to mark the end of DataField.

CHK1, CHK2: Two bytes character string.
CHK1 and CHK2 are the checksum of the data between Preamble and '*'.

CR, LF: Two bytes binary data.
The two bytes are used to identify the end of a packet.

Sample Packet:

$PJRC000*32<CR><LF>

JRC NMEA Packet Protocol:

In order to inform the sender whether the receiver has received the packet, an acknowledge packet PJRC_ACK should return after the receiver receives a packet.

1.1 Packet Type: 000 PJRC_TEST

Packet Meaning:

Test Packet.

DataField:

None

Example:

$PJRC000*3B<CR><LF>

1.2 Packet Type: 001 PJRC_ACK

Packet Meaning:

Acknowledge of PJRC command

DataField:

PJRC001,Cmd,Flag

Cmd: The command / packet type the acknowledge responds.

Flag: '0'= Invalid command / packet

'1'= Unsupported command / packet type

'2'= Valid command / packet, but action failed

'3'= Valid command / packet, and action succeeded

Example:

$PJRC001,604,3*3B<CR><LF>

1.3 Packet Type: 010 PJRC_SYS_MSG

Packet Meaning:

Output system message

DataField:

Msg: The system message.

'0': UNKNOWN

'1': STARTUP

Example:

$PJRC010,001*27<CR><LF>

1.4 Packet Type: 101 PJRC_CMD_HOT_START

Packet Meaning:

Hot Restart: Use all available data in the NV Store.

DataField:

None

Example:

$PJRC101*3B<CR><LF>

1.5 Packet Type: 102 PJRC_CMD_WARM_START

Packet Meaning:

Warm Restart: Don't use Ephemeris at re-start.

DataField:

None

Example:

$PJRC102*38<CR><LF>

1.6 Packet Type: 103 PJRC_CMD_COLD_START

Packet Meaning:

Cold Restart: Don't use Time, Position, Almanacs and Ephemeris data at re-start.

DataField:

None

Example:

$PJRC103*39<CR><LF>

1.7 Packet Type: 104 PJRC_CMD_FULL_COLD_START

Packet Meaning:

Full Cold Restart: It’s essentially a Cold Restart, but additionally clear system/user configurations at re-start. That is, reset the receiver to the factory status.

DataField:

None

Example:

$PJRC104*3E<CR><LF>

1.8 Packet Type: 251 PJRC_SET_NMEA_BAUDRATE

Packet Meaning:

Set NMEA port baudrate

DataField:

PJRC251,Baudrate

Baudrate: Baudrate setting

0 – default setting

4800

9600

14400

19200

38400

57600

115200

Example:

$PJRC251,38400*2E<CR><LF>

1.9 Packet Type: 300 PJRC_API_SET_FIX_CTL

Packet Meaning:

API_Set_Fix_Ctl This parameter controls the rate of position fixing activity.

DataField:

PJRC300,FixInterval,0,0,0,0

FixInterval: Position fix interval [msec]. Must be larger than 200.

Example:

$PJRC300,1000,0,0,0,0*15<CR><LF>

1.10 Packet Type: 301 PJRC_API_SET_DGPS_MODE

Packet Meaning:

API_Set_Dgps_Mode

DGPS correction data source mode.

DataField:

PJRC301,Mode

Mode: DGPS data source mode.

‘0’: No DGPS source

‘1’: RTCM

‘2’: WAAS

Example:

$PJRC301,1*24<CR><LF>

1.11 Packet Type: 313 PJRC_API_SET_SBAS_ENABLED

Packet Meaning:

API_Set_Sbas_Enabled Enable to search a SBAS satellite or not.

DataField:

Enabled: Enable or disable

‘0’ = Disable

‘1’ = Enable

Example:

$PJRC313,1*27<CR><LF>

1.12 Packet Type: 314 PJRC_API_SET_NMEA_OUTPUT

Packet Meaning:

API_Set_NMEA_Out

Set NMEA sentence output frequencies.

DataField:

There are totally **19** data fields but effective data field are **7**. The output frequency of **7** supported NMEA sentences can be set individually.

Supported NMEA Sentences

```
0 NMEA_SEN_GLL,        // GPGLL interval - Geographic Position - Latitude longitude
1 NMEA_SEN_RMC,        // GPRMC interval - Recomended Minimum Specific GNSS Sentence
2 NMEA_SEN_VTG,        // GPVTG interval - Course Over Ground and Ground Speed
3 NMEA_SEN_GGA,        // GPGGA interval - GPS Fix Data
4 NMEA_SEN_GSA,        // GPGSA interval - GNSS DOPS and Active Satellites
5 NMEA_SEN_GSV,        // GPGSV interval - GNSS Satellites in View
6 Null,                // Please always set 0.
7 Null,                // Please always set 0.
8 Null,                // Please always set 0.
9 Null,                // Please always set 0.
10 Null,               // Please always set 0.
11 Null,               // Please always set 0.
12 Null,               // Please always set 0.
13 Null,               // Please always set 0.
14 Null,               // Please always set 0.
15 Null,               // Please always set 0.
16 Null,               // Please always set 0.
17 NMEA_SEN_ZDA,       // GPZDA interval – Time & Date
18 Null,               // Please always set 0.
```

Supported Frequency Setting

0 - Disabled or not supported sentence
1 - Output once every one position fix
2 - Output once every two position fixes
3 - Output once every three position fixes
4 - Output once every four position fixes
5 - Output once every five position fixes

Example:

$PJRC314,1,1,1,1,1,5,1,1,1,1,1,0,0,0,0,0,0,1,0*25<CR><LF>

This command set GLL output frequency to be outputting once every 1 position fix, and RMC to be outputting once every 1 position fix, and so on.

You can also restore the system default setting via issue:
$PJRC314,-1*0D<CR><LF>

1.13 Packet Type: 330 PJRC_API_SET_DATUM

Packet Meaning:

API_Set_Datum

Set default datum.

DataField:

PJRC330,Datum

Datum: 0: WGS84

1: TOKYO-M

2: TOKYO-A

Support 219 different datums. The total datums list in the Appendix A.

Example:

$PJRC330,0*27<CR><LF>

1.14 Packet Type: 331 PJRC_API_SET_DATUM_ADVANCE

Packet Meaning:

API_Set_Datum_Advance

Set user defined datum.

DataField:

PJRC331,majA,ecc,dX,dY,dZ

majA: User defined datum semi-major axis [m]

ecc: User defined datumeccentric [m]

dX: User defined datum to WGS84 X axis offset [m]

dY: User defined datum to WGS84 X axis offset [m]

dZ: User defined datum to WGS84 X axis offset [m]

Example:

$PJRC331, 6377397.155, 299.1528128, -148.0, 507.0,685.0*1F<CR><LF>

1.15 Packet Type: 390 PJRC_API_SET_USER_OPTION

Packet Meaning:

API_Set_Flash_User_Option

Write the user setting to the flash to override the default setting. Maximum 8 times without erase the chip. This feature may not be available.

DataField:

PJRC390, Lock, Update_Rate, Baud_Rate, GLL_Period, RMC_Period, VTG_Period, GSA_Period, GSV_Period, GGA_Period, ZDA_Period, MCHN_Period, Datum, DGPS_Mode, RTCM_Baud_Rate

Lock: nonzero:freeze the setting; 0: allow further setting

Update_Rate: 1~5 (Hz)

Baud_Rate: 115200, 57600, 38400, 19200, 14400, 9600, 4800

RTCM_Baud_Rate: 115200, 57600, 38400, 19200, 14400, 9600, 4800

XXX_Period: NMEA sentence output period

DGPS_Mode: 0 (disable), 1 (RTCM), 2 (SBAS)

Datum: We support more than 200 datum. Please refer to Appendix A for the supported datum list.

The typical value is: 0 (WGS84), 1 (Tokyo-M), 2 (Tokyo-A)

Example:

$PJRC390,1,1,38400,1,1,1,1,1,1,1,0,0,2,9600*02<CR><LF>

1.16 Packet Type: 400 PJRC_API_Q_FIX_CTL

Packet Meaning:

API_Query_Fix_Ctl

DataField:

None

Return:

PJRC_DT_FIX_CTL

Example:

$PJRC400*3F<CR><LF>

1.17 Packet Type: 401 PJRC_API_Q_DGPS_MODE

Packet Meaning:

API_Query_Dgps_Mode

DataField:

None

Return:

PJRC_DT_DGPS_MODE

Example:

$PJRC401*3E<CR><LF>

1.18 Packet Type: 413 PJRC_API_Q_SBAS_ENABLED

Packet Meaning:

API_Query_Sbas_Enabled

DataField:

None

Return:

PJRC_DT_SBAS_ENABLED

Example:

$PJRC413*3D<CR><LF>

1.19 Packet Type: 414 PJRC_API_Q_NMEA_OUTPUT

Packet Meaning:

API_Query_NMEA_Out Query current NMEA sentence output frequencies.

DataField:

None

Return:

PJRC_DT_NMEA_OUTPUT

Example:

$PJRC414*3A<CR><LF>

1.20 Packet Type: 430 PJRC_API_Q_DATUM

Packet Meaning:

API_Query_Datum Query default datum

DataField:

None

Return:

PJRC_DT_DATUM

Example:

$PJRC430*3C<CR><LF>

1.21 Packet Type: 431 PJRC_API_Q_DATUM_ADVANCE

Packet Meaning:

API_Query_Datum_Advance

Query user defined datum

DataField:

None

Return:

PJRC_DT_DATUM

Example:

$PJRC431*3D<CR><LF>

1.22 Packet Type: 490 PJRC_API_GET_USER_OPTION

Packet Meaning:

API_Get_Flash_User_Option

Returns the current user setting from the flash memory. Please refer to Packet Type 590 for the detailed information.

DataField:

None

Return:

PJRC_DT_FLASH_USER_OPTION

Example:

$PJRC490*36<CR><LF>

1.23 Packet Type: 500 PJRC_DT_FIX_CTL

Packet Meaning:

These parameters control the rate of position fixing activity.

DataField:

FixInterval: Position fix interval. (msec). [>= 200]

Example:

$PJRC500,1000,0,0,0,0*13<CR><LF>

1.24 Packet Type: 501 PJRC_DT_DGPS_MODE

Packet Meaning:

DGPS Data Source Mode

DataField:

Mode: DGPS data source mode

'0': No DGPS source

'1': RTCM

'2': WAAS

Example:

$PJRC501,1*22<CR><LF>

1.25 Packet Type: 513 PJRC_DT_SBAS_ENABLED

Packet Meaning:

Enable to search a SBAS satellite or not.

DataField:

Enabled: Enable or disable

'0' = Disable

'1' = Enable

Example:

$PJRC513,1*21<CR><LF>

1.26 Packet Type: 514 PJRC_DT_NMEA_OUTPUT

Packet Meaning:

NMEA sentence output frequency setting

DataField:

There are totally **19** data fields that present output frequencies for the **19** supported NMEA sentences individually. Please refer to PJRC_API_SET_NMEA_OUTPUT for the Supported NMEA Sentences and Frequency Setting.

Example:

$PJRC514,1,1,1,1,1,5,1,1,1,1,1,1,0,1,1,1,1,1,1*23<CR><LF>

1.27 Packet Type: 530 PJRC_DT_DATUM

Packet Meaning:

Current datum used.

DataField:

PJRC530,Datum

Datum: 0: WGS84
1: TOKYO-M
2: TOKYO-A

Example:

$PJRC530,0*21<CR><LF>

1.28 Packet Type: 590 PJRC_DT_FLASH_USER_OPTION

Packet Meaning:

The user setting in the flash memory.

DataField:

There are totally 11 data fields that present the followings:

1.Available number of times for recording the user setting.

2. Update_Rate: 1~5

3. NMEA baud rate in bps

4~11: NMEA sentence output period (GLL, RMC, VTG, GSA, GSV, GGA, ZDA, MCHN)

12: Datum

13: DGPS mode: 0 (disable), 1 (RTCM), 2 (SBAS)

14: RTCM baud rate in bps

Example:

$PJRC590,0,1,9600,1,1,0,1,5,1,0,0,0,2,9600*31<CR><LF>

1.29 Packet Type: 605 PJRC_Q_RELEASE

Packet Meaning:

Query the firmware release information.

DataField:

NONE

Return:

PJRC_DT_RELEASE

Example:

$PJRC605*38<CR><LF>

1.30 Packet Type: 705 PJRC_DT_RELEASE

Packet Meaning:

Firmware release information.

DataField:

PJRC705,ReleaseStr,ModelID

ReleaseStr: Firmware release name and version

ModelID: Model ID

Example:

$PJRC705,Mcore_1.3,0000*1C<CR><LF>

2. Output Data Format (GPS Receiver to Host)

DDMMYY : Fixed length Date
hhmmss.sss : Fixed length Time
ddmm.mmmm : Fixed length Latitude
dddmm.mmmm : Fixed length Longitude
a : Character
u : '-' Sign ('+' sign is null)
xx.x : numeric(Variable length, decimal place is Fixed)
M : Units(Meters) or Magnetic Fixed field
T : True Fixed field
N : Units(knots) Fixed field
K : Units(km/h) Fixed field
hh : hexadecimal checksum
<CR><LF> : Carrige Return and Line Feed

2.1 GGA-Global positioning system fix data

$GPGGA,hhmmss.sss,ddmm.mmmm,a,dddmm.mmmm,a,x,xx,xx.xx,uxx.x,M,uxx.x,M,xxxx,xxxx*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10 11 12 13 14

Example

$GPGGA,040308.000,3539.2655,N,13944.7176,E,2,9,0.85,6.9,M,39.4,M,0000,0000*51

1: UTC Time (hour, minute, second)
2: Latitude (degree, minute)
3: N/S Indicator, N=north or S=south
4: Longitude(degree, minute)
5: E/W Indicator, E=east or W=west
6: GPS Quality Indicator
0: No Fix / Invalid
1: Standard GPS (2D/3D)
2: Differential GPS
6: Estimated (DR) Fix
7: Number of satellites for positioning(0 to 12)
8: HDOP, Horizontal Dilution of precision
9: Antenna Altitude above/below mean sea level
10: Units, meters
11: Geoidal separation
12: Units, meters
13: Age of differential GPS data, time in seconds since last SC104 1 or 9 update, null field when DGPS is not used

14: DGPS Reference Station ID, null field when DGPS is not used

2.2 GLL-Latitude and longitude, with time of position fix and status

$GPGLL,ddmm.mmmm,a,dddmm.mmmm,a,hhmmss.sss,a,a*hh<CR><LF>

1 2 3 4 5 6 7

Example

$GPGLL,3541.2891,N,13934.2581,E,055351.615,V,N*47

1: Latitude (degree, minute)
2: N/S Indicator, N=north or S=south
3: Longitude(degree, minute)
4: E/W Indicator, E=east or W=west
5: UTC Time (hour, minute, second)
6: Status
A:Valid
V:Invalid
7: Mode Indicator
A: Autonomous
D: Differential
E: Estimated (DR)
N: Data not valid

2.3 GSA-GPS DOP and Active Satellites

$GPGSA,a,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx.xx,xx.xx,xx.xx*hh<CR><LF>

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Example

$GPGSA,A,3,24,27,15,04,26,02,08,10,07,,,,2.04,0.87,1.84*0D

1: Receiver Mode
M: Manual (2 or 3 dimension)
A: AUTO
2: Position Mode
1: Fix not available
2: 2D
3: 3D
3-14: Satellite PRN No. (null for no satellite in case of less than 12 satellites)
15: PDOP, Position Dilution of precision
16: HDOP, Horizontal Dilution of precision
17: VDOP, Vertical Dilution of precision

2.4 GSV-GPS Satellites in View

$GPGSV,x,x,xx,xx,xx,xxx,xx,xx,xx,xxx,xx,xx,xx,xxx,xx,xx,xx,xxx,xx*hh<CR><LF>

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Example

$GPGSV,4,1,13,10,66,045,42,26,61,268,36,27,57,151,31,15,56,265,32*75
$GPGSV,4,2,13,24,54,299,39,42,48,179,39,08,38,058,34,02,33,163,32*73
$GPGSV,4,3,13,29,18,268,24,21,13,318,,07,06,036,18,28,04,101,*7C
$GPGSV,4,4,13,09,04,199,*47

1: Total number of GSV message
2: Current number of GSV message
3: Number of visible satellites
4: PRN No. of 1st satellite
5: Elevation of 1st satellite (0-90 degree)
6: Direction of 1st satellite (0-359 degree)
7: C/No of 1st satellite (0-99 dBHz, null when not tracking)
8-11: Data of 2nd satellite (same order as field 4-7)
12-15:Data of 3rd satellite (same order as field 4-7)
16-19:Data of 4th satellite (same order as field 4-7)

2.5 RMC-Recommended Minimum data

$GPRMC,hhmmss.sss,a,ddmm.mmmm,a,dddmm.mmmm,a,x.xx,xx.xx,DDMMYY,,,a*hh<CR><LF>

1 2 3 4 5 6 7 8 9 10 11 12

Example

$GPRMC,040004.000,A,3539.4637,N,13944.8084,E,0.00,315.14,190309,,,D*6E

1: UTC Time (hour, minute, second)
2: Status
A: Valid
V: Invalid
3: Latitude (degree, minute)
4: N/S Indicator, N=north or S=south
5: Longitude(degree, minute)
6: E/W Indicator, E=east or W=west
7: Speed (knots)
8: Forward Direction (degree)
9: UTC Date (day, month, year)
10: null
11: null
12: Mode Indicator
A: Autonomous

D: Differential
E: Estimated
N: Data not valid

2.6 VTG-Couse over ground and Ground speed

$GPVTG,xxx.xx,T,,M,x.xx,N,x.xx,K,a*hh<CR><LF>
1 2 3 4 5 6 7 8 9

Example

$GPVTG,20.72,T,,M,9.52,N,17.64,K,D*35

1: Forward Direction (degree)
2: T:True Fixed field
3: null
4: M:Magnetic Fixed field
5: Speed
6: N:knots Fixed field
7: Speed
8: K:km/h Fixed field
9: Mode Indicator
A: Autonomous
D: Differential
E: Estimated
N: Data not valid

Appendix A: Datum List

No	Datum	Region
0	WGS1984	International
1	Tokyo	Japan
2	Tokyo	Mean For Japan, South Korea, Okinawa
3	User Setting	User Setting
4	Adindan	Burkina Faso
5	Adindan	Cameroon
6	Adindan	Ethiopia
7	Adindan	Mali
8	Adindan	Mean For Ethiopia, Sudan
9	Adindan	Senegal
10	Adindan	Sudan
11	Afgooye	Somalia
12	Ain El Abd1970	Bahrain
13	Ain El Abd1970	Saudi Arabia
14	American Samoa1962	American Samoa Islands
15	Anna 1 Astro1965	Cocos Island
16	Antigua Island Astro1943	Antigua(Leeward Islands)
17	Arc1950	Botswana
18	Arc1950	Burundi
19	Arc1950	Lesotho
20	Arc1950	Malawi
21	Arc1950	Mean For Botswana, Lesotho, Malawi, Swaziland, Zaire, Zambia, Zimbabwe
22	Arc1950	Swaziland
23	Arc1950	Zaire
24	Arc1950	Zambia
25	Arc1950	Zimbabwe
26	Arc1960	Mean For Kenya Tanzania
27	Arc1960	Kenya
28	Arc1960	Tamzamia
29	Ascension Island1958	Ascension Island
30	Astro Beacon E 1945	Iwo Jima
31	Astro Dos 71/4	St Helena Island

32	Astro Tern Island (FRIG) 1961	Tern Island
33	Astronomical Station 1952	Marcus Island
34	Australian Geodetic 1966	Australia, Tasmania
35	Australian Geodetic 1984	Australia, Tasmania
36	Ayabelle Lighthouse	Djibouti
37	Bellevue (IGN)	Efate and Erromango Islands
38	Bermuda 1957	Bermuda
39	Bissau	Guuinea-Bissau
40	Bogota Observatory	Colombia
41	Bukit Rimpah	Indonesia(Bangka and Belitung Ids)
42	Camp Area Astro	Antarctica(McMurdi Camp Area)
43	Campo Inchauspe	Argentina
44	Canton Astro1966	Phoenix Island
45	Cape	South Africa
46	Cape Canaveral	Bahamas, Florida
47	Carthage	Tunisia
48	Chatham Island Astro1971	New Zealand(Chatham Island)
49	Chua Astro	Paraguay
50	Corrego Alegre	Brazil
51	Dabola	Guinea
52	Deception Island	Deception Island, Antarctia
53	Djakarta (Batavia)	Indonesia(Sumatra)
54	Dos 1968	New Georgia Islands (Gizo Island)
55	Easter Island 1967	Easter Island
56	Estonia Coordinate System1937	Estonia
57	European 1950	Cyprus
58	European 1950	Egypt
59	European 1950	England, Channel Islands, Scotland, Shetland Islands
60	European 1950	England, Ireland, Scotland, Shetland Islands
61	European 1950	Finland, Norway
62	European 1950	Greece
63	European 1950	Iran
64	European 1950	Italy (Sardinia)
65	European 1950	Italy (Slcily)
66	European 1950	Malta
67	European 1950	Mean For Austria, Belgium,Denmark, Finland, France, W Germany, Gibraltar, Greece, Italy, Luxembourg, Netherlands,

		Norway, Portuga,l Spain, Sweden, Switzerland
68	European 1950	Mean For Austria, Debnmark,France, W Germany, Netherland , Switzerland
69	European 1950	Mean For Irag, Israel, Jordan, Lebanon, Kuwait, Saudi Arabia, Syria
70	European 1950	Portugal, Spain
71	European 1950	Tunisia,
72	European 1979	Mean For Austria, Finland ,Netherlands ,Norway, Spain, Sweden, Switzerland
73	Fort Thomas 1955	Nevis St Kitts (Leeward Islands)
74	Gan 1970	Republic Of Maldives
75	Geodetic Dataum 1970	New Zealand
76	Graciosa Base SW1948	Azores (Faial, Graciosa, Pico, Sao, Jorge, Terceria)
77	Guam1963	Guam
78	Gunung Segara	Indonesia (Kalimantan)
79	Gux l Astro	Guadalcanal Island
80	Herat North	Afghanistan
81	Hermannskogel Datum	Croatia-Serbia, Bosnia-Herzegoivna
82	Hjorsey 1955	Iceland
83	Hongkong 1963	Hongkong
84	Hu Tzu Shan	Taiwan
85	Indian	Bangladesh
86	Indian	India,Nepal
87	Indian	Pakistan
88	Indian 1954	Thailand
89	Indian 1960	Vietnam (Con Son Island)
90	Indian 1960	Vietnam (Near 16 deg N)
91	Indian 1975	Thailand
92	Indonesian 1974	Indonesian
93	Ireland 1965	Ireland
94	ISTS 061 Astro 1968	South Georgia Islands
95	ISTS 073 Astro 1969	Diego Garcia
96	Johnston Island 1961	Johnston Island
97	Kandawala	Sri Lanka
98	Kerguelen Island 1949	Kerguelen Island
99	Kertau 1948	West Malaysia and Singapore
100	Kusaie Astro 1951	Caroline Islands
101	Korean Geodetic System	South Korea

102	LC5 Astro 1961	Cayman Brac Island
103	Leigon	Ghana
104	Liberia 1964	Liberia
105	Luzon	Philippines (Excluding Mindanao)
106	Luzon	Philippines (Mindanao)
107	M'Poraloko	Gabon
108	Mahe 1971	Mahe Island
109	Massawa	Ethiopia (Eritrea)
110	Merchich	Morocco
111	Midway Astro 1961	Midway Islands
112	Minna	Cameroon
113	Minna	Nigeria
114	Montserrat Island Astro 1958	Montserrat (Leeward Island)
115	Nahrwan	Oman (Masirah Island)
116	Nahrwan	Saudi Arabia
117	Nahrwan	United Arab Emirates
118	Naparima BWI	Trinidad and Tobago
119	North American 1927	Alaska (Excluding Aleutian Ids)
120	North American 1927	Alaska (Aleutian Ids East of 180 degW)
121	North American 1927	Alaska (Aleutian Ids West of 180 degW)
122	North American 1927	Bahamas (Except San Salvador Islands)
123	North American 1927	Bahamas (San Salvador Islands)
124	North American 1927	Canada (Alberta, British Columbia)
125	North American 1927	Canada (Manitoba, Ontario)
126	North American 1927	Canada (New Brunswick, Newfoundland, Nova Scotia, Qubec)
127	North American 1927	Canada (Northwest Territories, Saskatchewan)
128	North American 1927	Canada (Yukon)
129	North American 1927	Canal Zone
130	North American 1927	Cuba
131	North American 1927	Greenland (Hayes Peninsula)
132	North American 1927	Mean For Antigua, Barbados, Barbuda, Caicos Islands, Cuba, Dominican, Grand Cayman, Jamaica, Turks Islands
133	North American 1927	Mean For Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua
134	North American 1927	Mean For Canada
135	North American 1927	Mean For Conus
136	North American 1927	Mean For Conus (East of Mississippi, River Including Louisiana, Missouri, Minnesota)

137	North American 1927	Mean For Conus (West of Mississippi, Rive Excluding Louisiana, Minnesota, Missouri)
138	North American 1927	Mexico
139	North American 1983	Alaska (Excluding Aleutian Ids)
140	North American 1983	Aleutian Ids
141	North American 1983	Canada
142	North American 1983	Conus
143	North American 1983	Hahawii
144	North American 1983	Mexico, Central America
145	North Sahara 1959	Algeria
146	Observatorio Meteorologico 1939	Azores (Corvo and Flores Islands)
147	Old Egyptian 1907	Egypt
148	Old Hawaiian	Hawaii
149	Old Hawaiian	Kauai
150	Old Hawaiian	Maui
151	Old Hawaiian	Mean For Hawaii, Kauai, Maui, Oahu
152	Old Hawaiian	Oahu
153	Oman	Oman
154	Ordnance Survey Great Britian 1936	England
155	Ordnance Survey Great Britian 1936	England, Isle of Man, Wales
156	Ordnance Survey Great Britian 1936	Mean For England ,Isle of Man, Scotland, Shetland Island, Wales
157	Ordnance Survey Great Britian 1936	Scotland, Shetland Islands
158	Ordnance Survey Great Britian 1936	Wales
159	Pico de las Nieves	Canary Islands
160	Pitcairn Astro 1967	Pitcairn Island
161	Point 58	Mean For Burkina Faso and Niger
162	Pointe Noire 1948	Congo
163	Porto Santo 1936	Porto Santo, Maderia Islands
164	Provisional South American 1956	Bolovia
165	Provisional South American 1956	Chile (Northern Near 19 deg S)
166	Provisional South American 1956	Chile (Southern Near 43 deg S)

167	Provisional South American 1956	Colombia
168	Provisional South American 1956	Ecuador
169	Provisional South American 1956	Guyana
170	Provisional South American 1956	Mean For Bolivia Chile,Colombia, Ecuador, Guyana, Peru, Venezuela
171	Provisional South American 1956	Peru
172	Provisional South American 1956	Venezuela
173	Provisional South Chilean 1963	Chile (Near 53 deg S) (Hito XVIII)
174	Puerto Rico	Puerto Rico, Virgin Islands
175	Pulkovo 1942	Russia
176	Qatar National	Qatar
177	Qornoq	Greenland (South)
178	Reunion	Mascarene Island
179	Rome 1940	Italy (Sardinia)
180	S-42 (Pulkovo 1942)	Hungary
181	S-42 (Pulkovo 1942)	Poland
182	S-42 (Pulkovo 1942)	Czechoslavakia
183	S-42 (Pulkovo 1942)	Lativa
184	S-42 (Pulkovo 1942)	Kazakhstan
185	S-42 (Pulkovo 1942)	Albania
186	S-42 (Pulkovo 1942)	Romania
187	S-JTSK	Czechoslavakia (Prior 1 Jan1993)
188	Santo (Dos) 1965	Espirito Santo Island
189	Sao Braz	Azores (Sao Miguel, Santa Maria Ids)
190	Sapper Hill 1943	East Falkland Island
191	Schwarzeck	Namibia
192	Selvagem Grande 1938	Salvage Islands
193	Sierra Leone 1960	Sierra Leone
194	South American 1969	Argentina
195	South American 1969	Bolivia
196	South American 1969	Brazial
197	South American 1969	Chile
198	South American 1969	Colombia
199	South American 1969	Ecuador

200	South American 1969	Ecuador (Baltra, Galapagos)
201	South American 1969	Guyana
202	South American 1969	Mean For Argentina, Bolivia, Brazil,Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Trinidad and Tobago, Venezuela
203	South American 1969	Paraguay
204	South American 1969	Peru
205	South American 1969	Trinidad and Tobago
206	South American 1969	Venezuela
207	South Asia	Singapore
208	Tananarive Observatory 1925	Madagascar
209	Timbalai 1948	Brunei, E Malaysia (Sabah Sarawak)
210	Tokyo	Japan
211	Tokyo	Mean For Japan, South Korea, Okinawa
212	Tokyo	Okinawa
213	Tokyo	South Korea
214	Tristan Astro 1968	Tristam Da Cunha
215	Viti Levu 1916	Fiji (Viti Levu Island)
216	Voirol 1960	Algeria
217	Wake Island Astro 1952	Wake Atoll
218	Wake-Eniwetok 1960	Marshall Islands
219	WGS 1972	Global Definition
220	WGS 1984	Global Definition
221	Yacare	Uruguay
222	Zanderij	Suriname

Appendix B: Pinning function

Pinning function is a special filter for car.
When user moves low speed (Speed can select 0(No function), 0.2,0.4,0.6,0.8,1.0,1.5[m/s].), the position is kept constant. The speed is determined for each firmware, and it cannot change. Please select 0[m/s](No function), when user use to human, ship, etc (It continue low speed long time.).
Speed can set using following command. If VBU (Backup power) will be lost, the settings will revert to default.

Command

$PJRC397,speed*checksum<CR><LF>

speed: 0, 0.2, 0.4, 0.6, 0.8, 1.0, 1.5

Example

$PJRC397,0*2A<CR><LF>
$PJRC397,1.5*30<CR><LF>

Appendix C: Extrapolating Positioning

If the receiver no longer position fix, it keeps fix track (speed and heading are kept to the last calculated) until the Timeout (~9[s]) is reached. The position is extrapolated. It's indicated as "Estimated (DR)".